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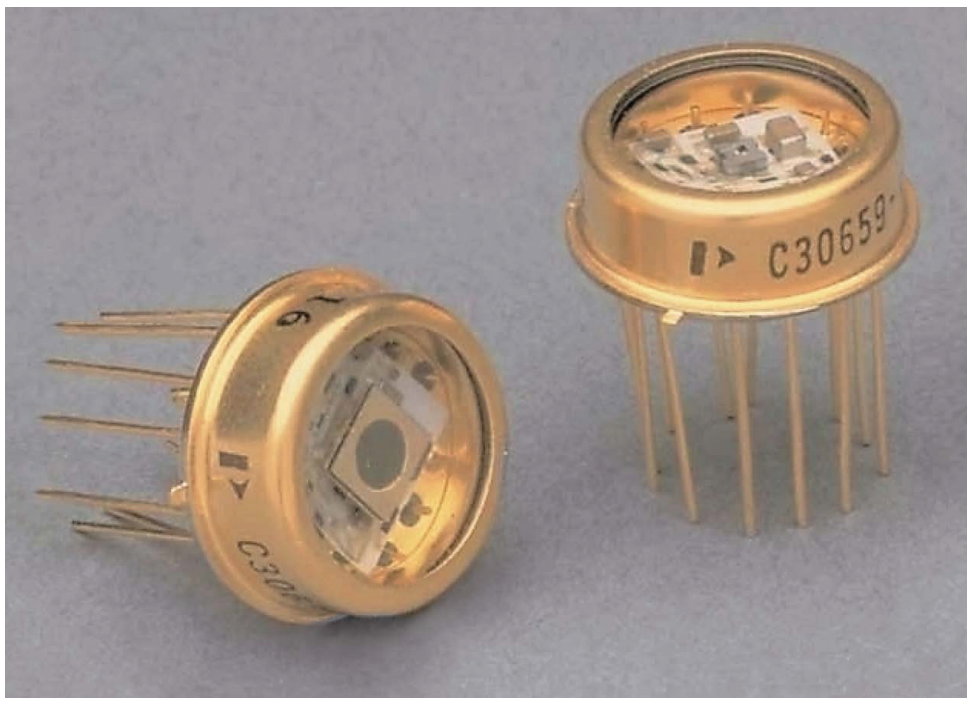
Optoelectronics

Preliminary Data Sheet

C30659-900-1060-1550nm Series

Silicon and InGaAs APD Preamplifier Modules

PRELIMINARY DATASHEET



Applications

- Range Finding
- Confocal Microscope
- LIDAR

Features

- System bandwidth 50 MHz and 200 MHz
- Ultra low noise equivalent power (NEP)
- Spectral response range:
  Silicon APD: 400 to 1100nm
  InGaAs APD: 1100 to 1700nm
- Power consumption (150 mW typ.)
- +/-5 Volts amplifier operating voltages
- 50 Ω AC Load capability
- Hermetically sealed TO-8 packages
- High reliability
- Fast overload recovery
- Pin compatible with the C30950 series
- Light entry angle ∅130°

Description

PerkinElmer C30659 Series includes a Silicon or InGaAs Avalanche Photodiode with a hybrid preamplifier. It is supplied in a single modified 12-lead TO-8 package.

The avalanche photodiodes used in these devices are the C30817E, C30902E, C30954E, C30956E, C30645E and C30662E that provide very good response between 830 and 1550 nanometers and very fast rise and fall times at all wavelengths. The preamplifier section uses a very low noise GaAs FET front end designed to operate at higher transimpedance than the regular C30950 series.

The C30659 is pin to pin compatible with the C30950 series. The output of the C30659 is negative. An emitter follower is used as an output buffer stage. To obtain the wideband characteristics, the output of these devices should be AC (capacitively) coupled to a 50 Ohm termination. The module must not be DC coupled to loads of less than 2,000 Ohms.

For field use, it is recommended that a temperature compensated HV supply be employed to maintain responsivity constant over temperature.

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precisely.

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Table 1. Electrical Characteristics at T_A=22ºC

Test Conditions: Ambient Temperature, V_{amp} = ±5 Volts, HV = +V_R (see Note 1), R_L = 50Ω AC Coupled

	900nm Silicon APD						
Detector Type	C30659-900-R8A (Si APD C30817E)			C30659-900-R5B (Si APD C30902E)			
	Min	Typ	Max	Min	Typ	Max	
Active Diameter		0.8			0.5		mm
Active Area		0.5			0.2		mm^2
Bandwidth Range		50			200		MHz
Temperature Coefficient of V_R for constant Gain	-	2.2	-	-	0.7	-	V/°C
VR for specified responsivity	275	Note 1	435	180	Note 1	260	V
Temperature sensor sensitivity	-1.8	-2.1	-2.4	-1.8	-2.1	-2.4	mV/°C
Responsivity							
At 830nm	-	2700	-	-	460	-	kV/W
At 900nm	-	3000	-	-	400	-	kV/W
R_F (Internal Feedback Resistor)	-	82	-	-	12	-	k Ω
Noise Equivalent Power (NEP) (note 3) f - 100 kHz, Δf = 1.0 Hz							
At 830nm	-	14	17	-	35	55	fW/√Hz
At 900nm	-	12	15	-	40	65	fW/√Hz
Output Spectral Noise Voltage: (f = 100 kHz - f_{-3dB})	-	35	45	-	15	25	nV/√Hz
Output Impedance	33	40	50	33	40	50	Ω
System Bandwidth, f_{-3dB}	40	50	-	175	200	-	MHz
Rise Time, t_r (λ = 830 and 900nm) 10% to 90% points	-	7	-	-	2	-	ns
Fall Time, t_f (λ = 830 and 900nm) 90% to 10% points	-	7	-	-	2	-	ns
Recovery time after overload (note 4)	-	-	150	-	-	150	ns
Output Voltage Swing (1kΩ load) (note 5)	2	3	-	2	3	-	V
Output Voltage Swing (50Ω load) (note 5)	0.7	0.9	-	0.7	0.9	-	V
Output Offset Voltage	-1	0.25	1	-1	0.25	1	V
Positive Supply Current (V+)	-	20	35	-	20	35	mA
Negative Supply Current (V-)	-	10	20	-	10	20	mA

Notes: 1. A specific value of V_R is supplied with each device. The V_R value will be within the specified ranges.
2. I_f = 0.1 mA, 25°C
3. NEPmax is the Maximum Output Spectral Noise Voltage max divided by the typical Responsivity.
4. 0dBm, 250ns pulse.
5. Pulsed operation.

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Table 2. Electrical Characteristics at T_A=22ºC

Test Conditions: Ambient Temperature, V_{amp} = ±5 Volts, HV = +V_R (see Note 1), R_L = 50Ω AC Coupled

	1060nm Silicon APD						
Detector Type	C30659-1060-3A (Si APD C30956E)			C30659-1060-R8B (Si APD C30954E)			
	Min	Typ	Max	Min	Typ	Max	
Active Diameter		3.0			0.8		mm
Active Area		7.1			0.5		mm^2
Bandwidth Range		50			200		MHz
Temperature Coefficient of V_R for constant Gain	-	2.2	-	-	2.2	-	V/°C
VR for specified responsivity	275	Note 1	425	275	Note 1	425	V
Temperature sensor sensitivity	-1.8	-2.1	-2.4	-1.8	-2.1	-2.4	mV/°C
Responsivity							
At 900nm	-	450	-	-	370	-	kV/W
At 1060nm	-	280	-	-	200	-	kV/W
R_F (Internal Feedback Resistor)	-	22	-	-	12	-	k Ω
Noise Equivalent Power (NEP) (note 3) f - 100 kHz, Δf = 1.0 Hz							
At 900nm	-	55	80	-	55	80	fW/√Hz
At 1060nm	-	90	125	-	100	150	fW/√Hz
Output Spectral Voltage: (f = 100 kHz - f_{-3dB})	-	25	35	-	20	30	nV/√Hz
Output Impedance	33	40	50	33	40	50	Ω
System Bandwidth, f_{-3dB}	40	50	-	175	200	-	MHz
Rise Time, t_r (λ = 900 and 1060nm) 10% to 90% points	-	7	-	-	2	-	ns
Fall Time, t_f (λ = 830 and 900nm) 90% to 10% points	-	7	-	-	2	-	ns
Recovery time after overload (note 4)	-	-	150	-	-	150	ns
Output Voltage Swing (1kΩ load) (note 5)	2	3	-	2	3	-	V
Output Voltage Swing (50Ω load) (note 5)	0.7	0.9	-	0.7	0.9	-	V
Output Offset Voltage	-1	0.25	1	-1	0.25	1	V
Positive Supply Current (V+)	-	20	35	-	20	35	mA
Negative Supply Current (V-)	-	10	20	-	10	20	mA

Notes: 1. A specific value of V_R is supplied with each device. The V_R value will be within the specified ranges.
2. I_f = 0.1 mA, 25°C
3. NEPmax is the Maximum Output Spectral Noise Voltage max divided by the typical Responsivity.
4. 0dBm, 250ns pulse.
5. Pulsed operation.

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Table 3. Electrical Characteristics at T_A=22ºC

Test Conditions: Ambient Temperature, V_{amp} = ±5 Volts, HV = +V_R (see Note 1), R_L = 50Ω AC Coupled

	1550nm InGaAs APD						
Detector Type	C30659-1550-R2A (InGaAs APD C30662E)			C30659-1550-R08B (InGaAs APD C30645E)			
	Min	Typ	Max	Min	Typ	Max	
Active Diameter		0.2			0.08		mm
Active Area		0.03			0.005		mm^2
Bandwidth Range		50			200		MHz
Temperature Coefficient of V_R for constant Gain	-	0.2	-	-	0.2	-	V/°C
VR for specified responsivity	40	Note 1	70	40	Note 1	70	V
Temperature sensor sensitivity	-1.8	-2.1	-2.4	-1.8	-2.1	-2.4	mV/°C
Responsivity							
At 1300nm	-	300	-	-	80	-	kV/W
At 1550nm	-	340	-	-	90	-	kV/W
R_F (Internal Feedback Resistor)	-	68	-	-	18	-	k Ω
Noise Equivalent Power (NEP) (note 3) f - 100 kHz, Δf = 1.0 Hz							
At 1300nm	-	150	180	-	250	375	fW/√Hz
At 1550nm	-	130	160	-	220	330	fW/√Hz
Output Spectral Voltage: (f = 100 kHz - f_{-3dB})	-	45	55	-	20	30	nV/√Hz
Output Impedance	33	40	50	33	40	50	Ω
System Bandwidth, f_{-3dB}	40	50	-	175	200	-	MHz
Rise Time, t_r (λ = 900 and 1060nm) 10% to 90% points	-	7	-	-	2	-	ns
Fall Time, t_f (λ = 830 and 900nm) 90% to 10% points	-	7	-	-	2	-	ns
Recovery time after overload (note 4)	-	-	150	-	-	150	ns
Output Voltage Swing (1kΩ load) (note 5)	2	3	-	2	3	-	V
Output Voltage Swing (50Ω load) (note 5)	0.7	0.9	-	0.7	0.9	-	V
Output Offset Voltage	-1	-0.3	1	-1	-0.3	1	V
Positive Supply Current (V+)	-	20	35	-	20	35	mA
Negative Supply Current (V-)	-	10	20	-	10	20	mA

Notes: 1. A specific value of V_R is supplied with each device. The V_R value will be within the specified ranges.
2. I_f = 0.1 mA, 25°C
3. NEPmax is the Maximum Output Spectral Noise Voltage divided by the typical Responsivity.
4. 0dBm, 250ns pulse.
5. Pulsed operation.

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Figure 1. C30659 Series Block Diagram

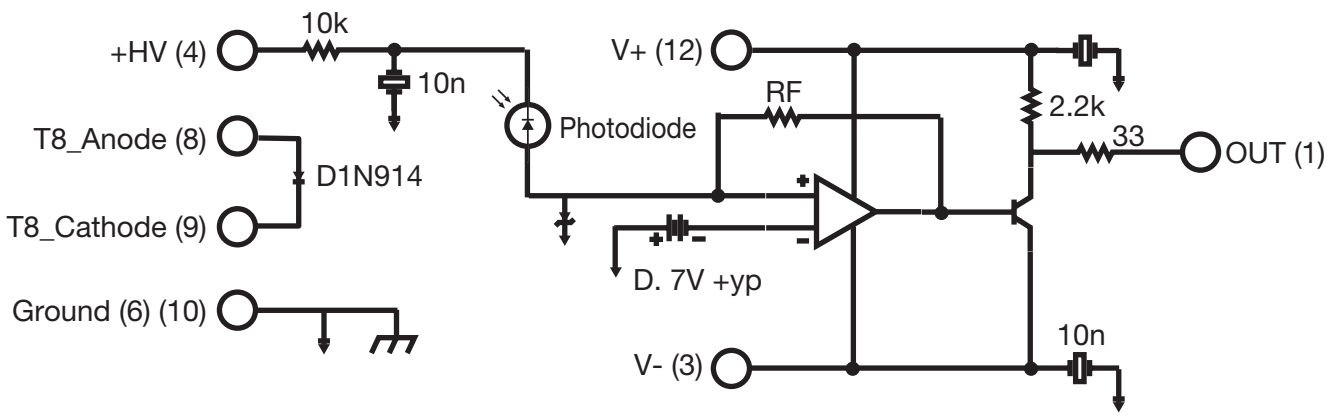
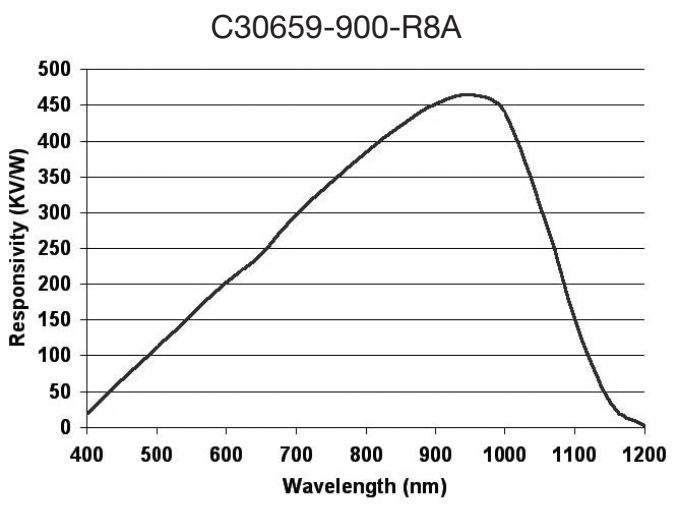
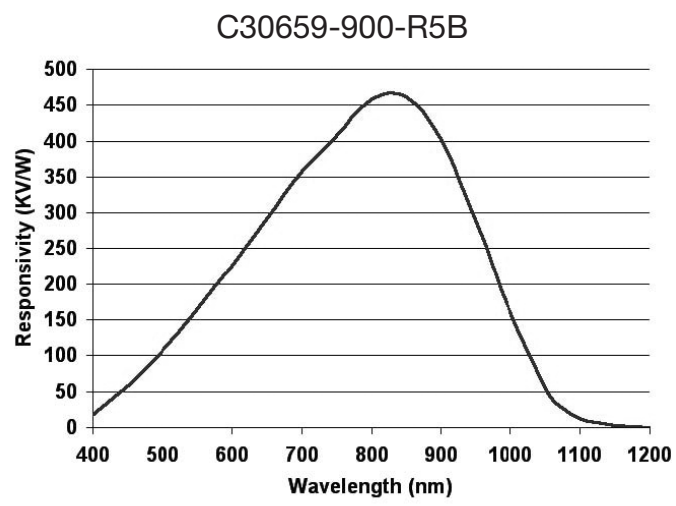
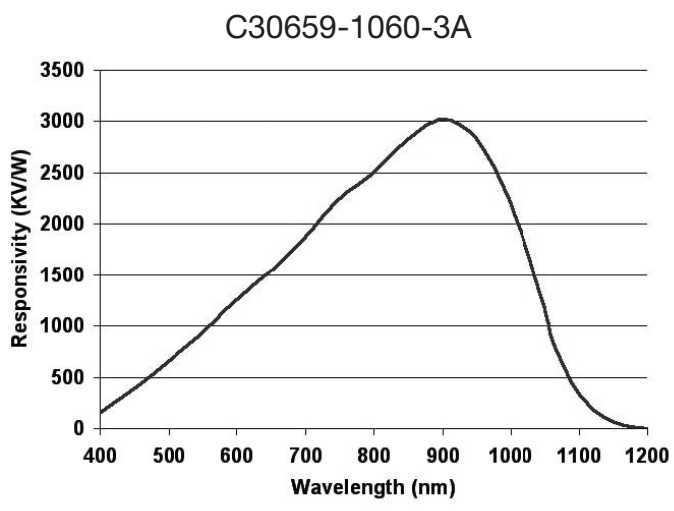


Figure 2. Spectral Responsivity







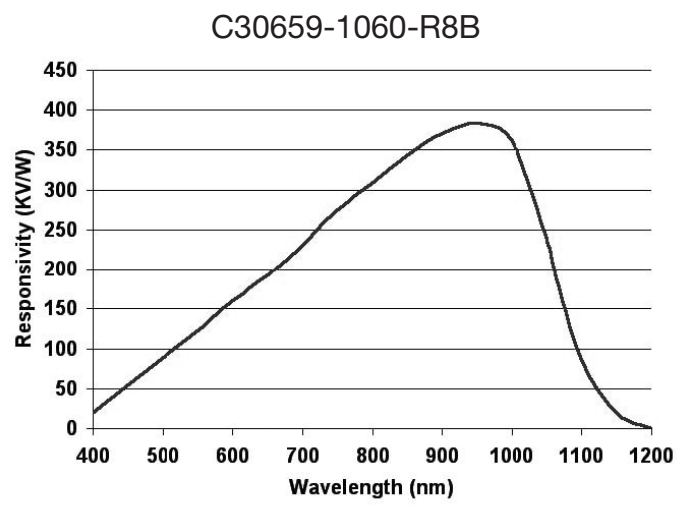


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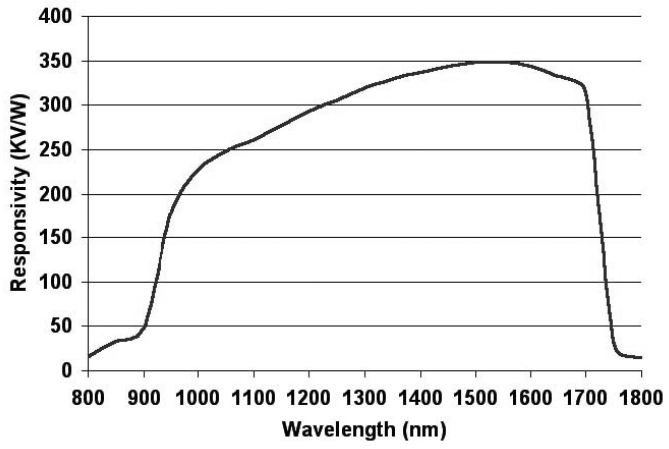
Figure 2. Spectral Responsivity, continued

C30659-1550-R2A



C30659-1550-R08B

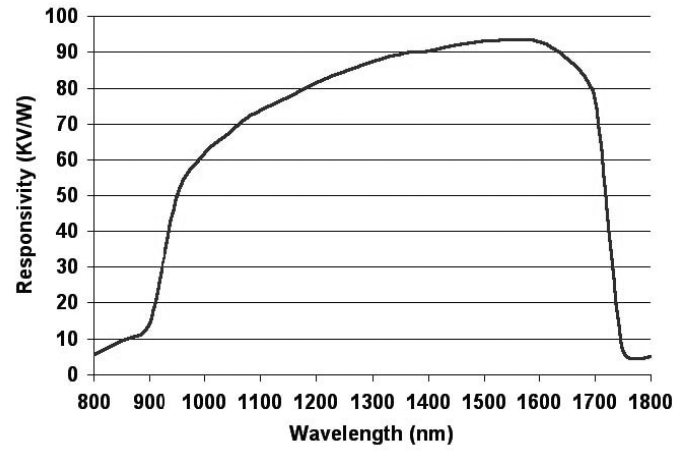
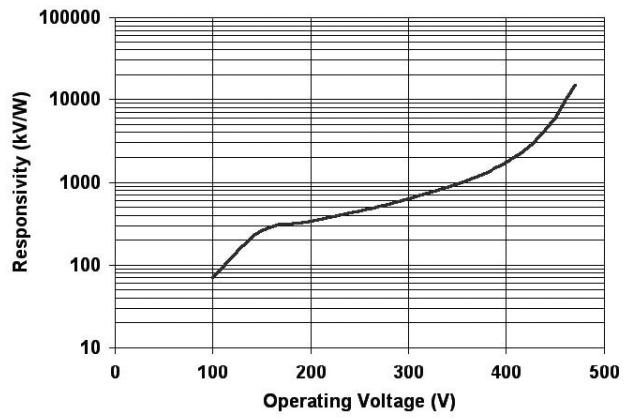
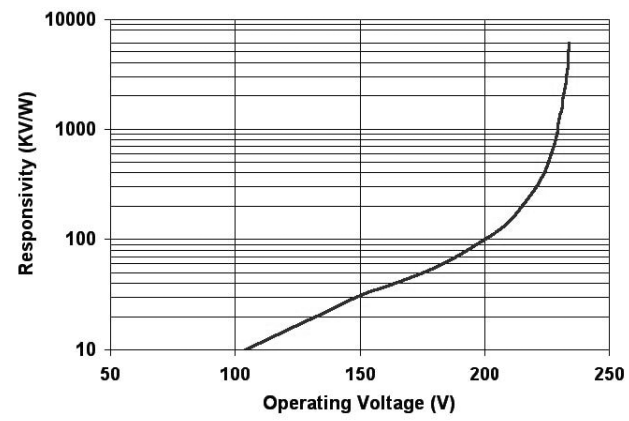


Figure 3. Responsivity

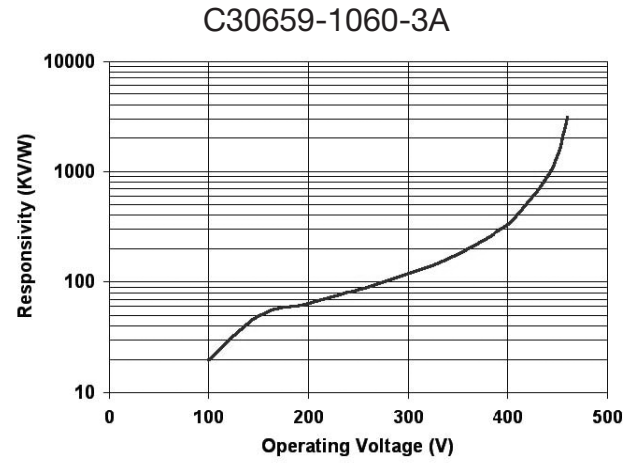
C30659-900-R8A



C30659-900-R5B



C30659-1060-3A



C30659-1060-R8B

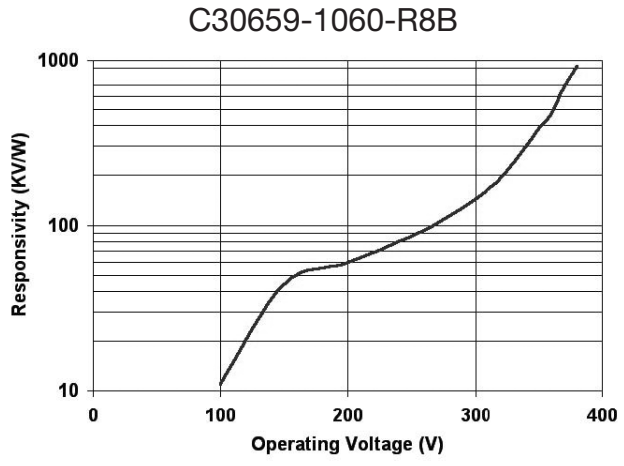


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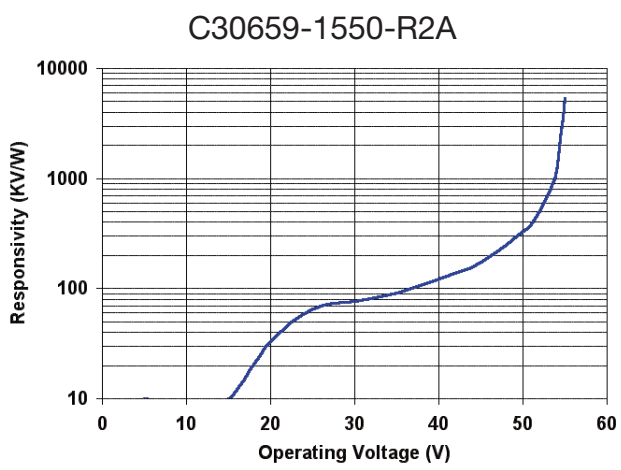
Figure 3. Responsivity, continued



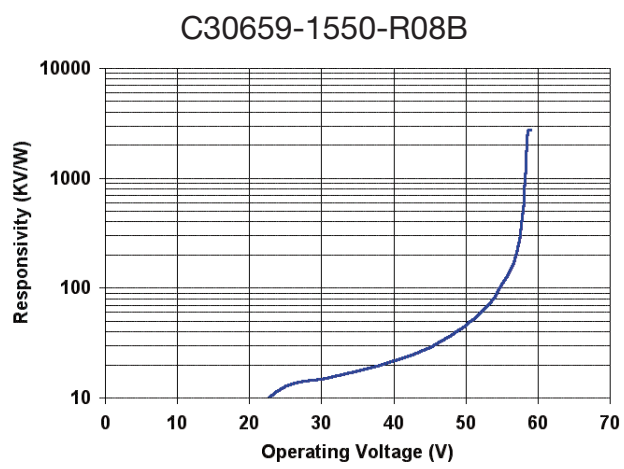
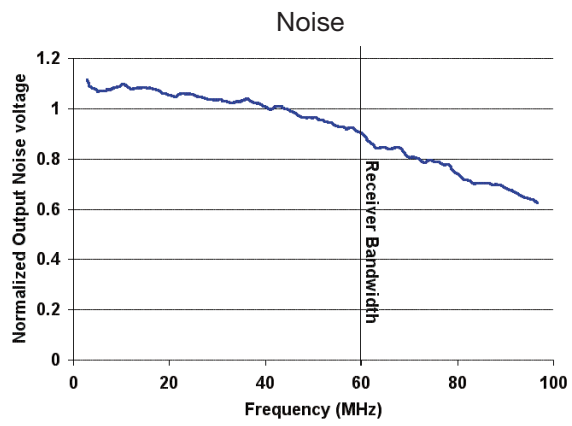
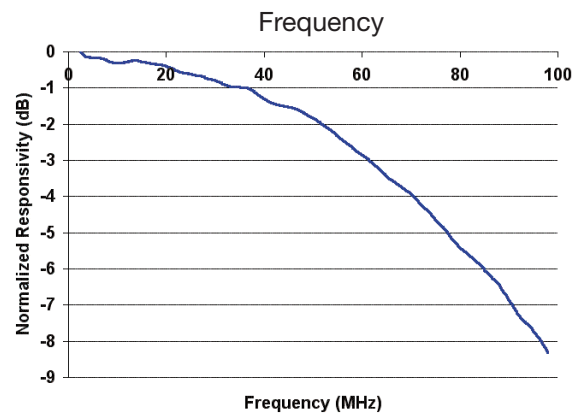


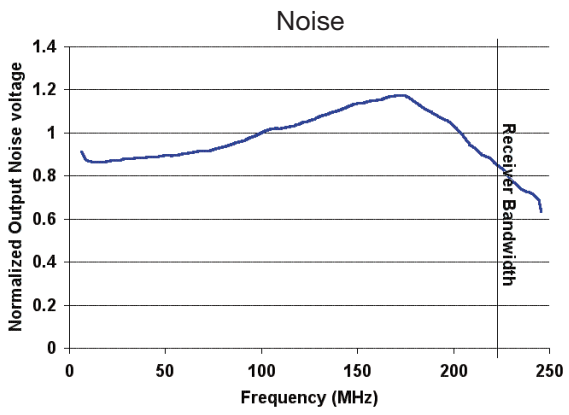
Figure 4. Typical Response / Noise Curves

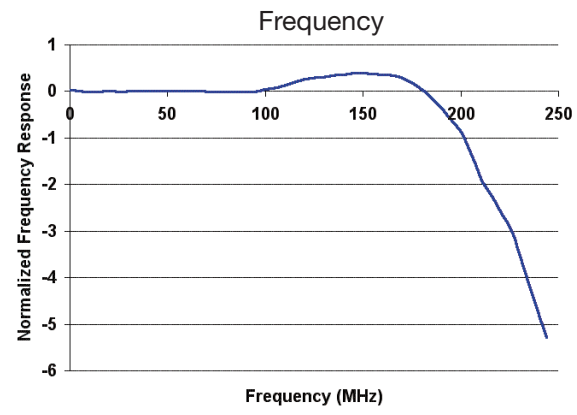
50 MHz Receivers





200 MHz Receivers





Output voltage noise normalization is calculated using the following formula:

$$Vn_{normalized} = \frac{Vn}{Vn_{average}}$$

$$Vn_{average}\left(\frac{V}{\sqrt{Hz}}\right) = \sqrt{\frac{\int_{100Hz}^{f_{-3dB}} Vn^2 \cdot df}{f_{-3dB}}}$$

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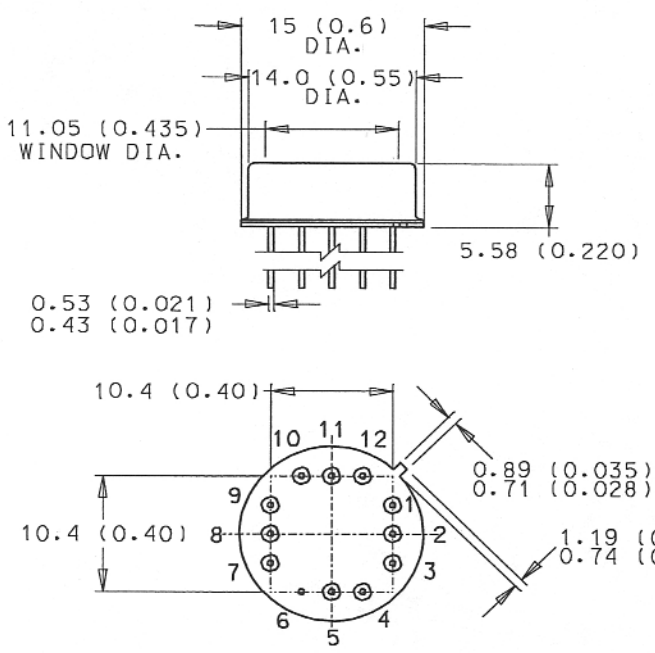
Table 4. Absolute - Maximum Ratings, Limiting Values

	C30659-900 (Si)			C30659-1060 (Si)			C30659-1550 (InGaAs)			
	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
Photodiode Bias Voltage:										
At TA = +70°C	-	-	600	-	-	600	-	-	100	V
At TA = - 40°C	-	-	300	-	-	300	-	-	50	V
Incident Radiant Flux Φ_M										
average	-	-	0.1[1]	-	-	0.1[1]	-	-	2[1]	mW
peak	-	-	50[2]	-	-	50[2]	-	-	50[2]	mW
Case Temperature:										
Storage, T_{stg}	-50	-	100	-50	-	100	-50	-	100	°C
Operating, T_A	-40	-	70	-40	-	70	-40	-	70	°C
Preamplifier Voltage:	-4.5	-	-5.5	-4.5	-	-5.5	-4.5	-	-5.5	V

Notes: 1. Based on 0.5W electrical power on high voltage supply.
2. Test with pulse width of 50 ns.

Figure 5. Mechanical Characteristics



PIN CONNECTIONS

1: Signal Output
2: No Connection
3: -Vcc Negative Amplifier Bias
4: Positive high voltage
5: No Connection
6: Case Ground
7: No Connection
8: Temp. Sensing Diode - Anode
9: Temp. Sensing Diode - Cathode
10: Ground, DC returns
11: No Connection
12: +Vcc Positive Amplifier Bias

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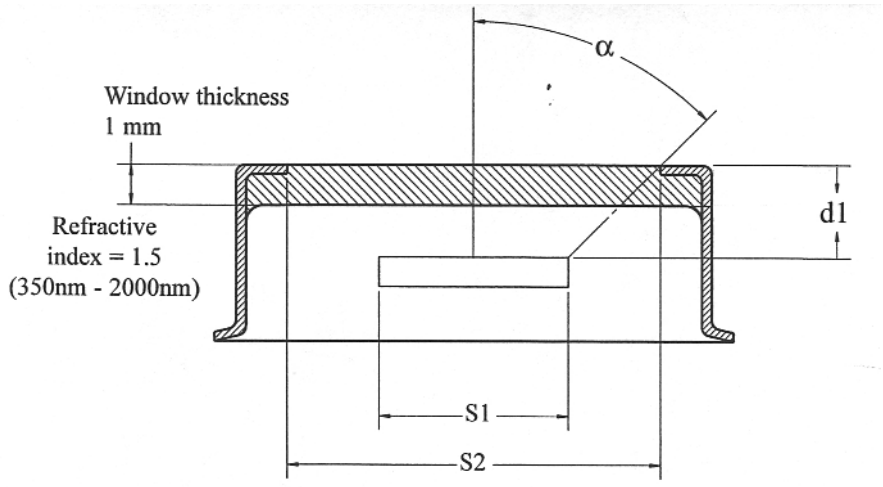
Figure 6. Optical Geometry



Model	Detector	S1 (mm)	S2 (mm)	d1 (mm)	α (deg)
C30659-900-R8A	C30817E	0.80	11	1.4	70
C30659-900-R5B	C30902E	0.50	11	1.4	70
C30659-1060-3A	C30956E	3.00	11	1.3	65
C30659-1060-R8B	C30954E	0.80	11	1.3	70
C30659-1550-R2A	C30662E	0.20	11	1.5	70
C30659-1550-R08B	C30645E	0.08	11	1.5	70

Table 5. Ordering Guide

Model	Description
C30659-900-R8A	50 MHz, 900nm, 0.8mm Active Region Diameter
C30659-900-R5B	200 MHz, 900nm, 0.5mm Active Region Diameter
C30659-1060-3A	50 MHz, 1060nm, 3mm Active Region Diameter
C30659-1060-R8B	200 MHz, 1060nm, 0.8mm Active Region Diameter
C30659-1550-R2A	50 MHz, 1550nm, 0.2mm Active Region Diameter
C30659-1550-R08B	200 MHz, 1550nm, 0.08mm Active Region Diameter

Ordering Information

While the information in this data sheet is intended to describe the form, fit and function for this product, PerkinElmer reserves the right to make changes without notice.

For more information e-mail us at opto@perkinelmer.com or visit our web site at www.optoelectronics.perkinelmer.com.
All values are nominal; specifications subject to change without notice.

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